VNR10M

Virudhunagar District
Common Half Yearly Examination - December 2023

Standard - 10
MATHS

Time Allowed: 3.00 Hours

Maximum Marks: 100

I. Answer the following:

14 × 1 = 14

1. Let n (A) = m and n (B) = n then the total number of non-empty relations that can be defined from A to B is
   a) m^n b) n^m c) $2^{mn} - 1$ d) 2^{mn}

2. f(x) = $(x+1)^3 - (x-1)^3$ represents a function which is
   a) linear   b) cubic
   c) reciprocal   d) quadratic

3. $7^{4k} \equiv$ _____ mod(100).
   a) 1   b) 2   c) 3   d) 4

4. Using Euclid's division lemma, if the cube of any positive integer is divided by 9 then the possible reminders are
   a) 0,1,8   b) 1,4,8   c) 0,1,3   d) 1,3,5

5. The solution of $(2x-1)^2 = 9$ is equal to
   a) -1   b) 2   c) -1,2   d) None of these

6. Find the value of a from the following equations $\begin{pmatrix} a-b & 5 \\ 0 & 2 \end{pmatrix} = \begin{pmatrix} -3 & 5 \\ 2a-b & 2 \end{pmatrix}$

   a) -1   b) 2   c) 3   d) 0

7. If ΔABC is an isosceles triangle with ∠C= 90° and AC = 5cm, the AB is
   a) 2.5 cm   b) 5 cm   c) 10 cm   d) $5\sqrt{2}$ cm

8. How many tangents can be drawn to the circle from an exterior point
   a) one   b) two   c) infinite   d) zero

9. The slope of the line which is perpendicular to a line joining the points
   a) -1   b) 1   c) $\frac{1}{3}$ d) -8

10. If sinθ = cosθ, then $2\tan^2\theta + \sin^2\theta -1$ is
    a) $\frac{-3}{2}$ b) $\frac{3}{2}$ c) $\frac{2}{3}$ d) $\frac{-2}{3}$

11. The ratio of the curved surface area of a sphere and the curved surface area of a hemisphere
    a) 2:1   b) 1:2   c) 1:1   d) 1:3

12. The height of a right circular cone whose radius is 5 cm and slant height is 13 cm will be
    a) 12 cm   b) 10 cm   c) 13 cm   d) 5 cm

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13. The probability of getting 100 marks in maths for a student is $\frac{4}{5}$. If the probability of not getting 100 marks in maths

a) $\frac{1}{5}$ b) $\frac{2}{5}$ c) $\frac{3}{5}$ d) $\frac{4}{5}$

14. If the standard deviation of p,q,r, is S,then the standard deviation of p-3, q-3, r-3 is

a) S-3   b) 3S   c) S   d) 3-S

II. Answer any 10 questions: (Q.No.28 is compulsory)   10×2=20

15. Let A = {3,4,7,8} and B = {1,7,10} which of the following sets are relations from A to B?

(i) R = {(3,7) (4,7) (7,10) (8,1)}

(ii)R_2 = {(3,1) (4,12)}

16. If f(x) = x²-1, g(x) = x-2. Find a, if go f(a) = 1.

17. Find the 8ᵗʰ term of the G.P 9,3,1,.......

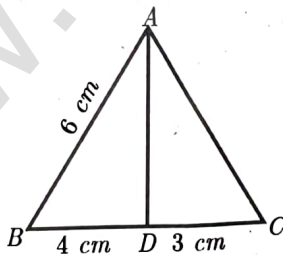18. If 1³ + 2³ + 3³ + ... + K³ = 16900, then find. 1+2+3+.....+K.

19. Reduce the rational expressions to its lowest form: $\frac{x^2 - 1}{x^2 + x}$.

20. Determine the nature of the roots for the following quadratic equations: $\sqrt{2}t^2 - 3t + 3\sqrt{2} = 0$.

21. In the fig, AD is the bisector of ∠A.

If BD = 4cm, DC = 3cm and AB = 6cm, find AC.

22. Calculate the slope and g intercept of the straight line 8x-7y+6 = 0.

23. Prove that $\sqrt{\dfrac{1 + \cos\theta}{1 - \cos\theta}}$ = cosec θ + cot θ.

24. The curved surface area of a right circular cylinder of height 14cm is 88cm². Find the diameter of the cylinder.

25. The volumes of two cones of same base radius are 3600cm³ and 5040cm³. Find the ratio of heights.

26. If the mean and coefficient of a data are 15 and 48 respectively, then find the value of standard deviator.

27. A coin is tossed thrice. What is the probability of getting exactly two tails?

28. Find the equation of a straight line which has slope $\dfrac{-5}{4}$ and passing through the points (-1,2).

III. Answer any 10 questions: (Q.No.42 is compulsory)   10×5=50

29. Let A = {X∈ W / 0 < x < 5} B = {X∈ W / 0 ≤ x ≤ 2} C = {X∈ W / x < 3} then verify that A × (B∩C) = (A×B)∩(A×C).

30. Let A = {1,2,3,4} and B = {2,5,8,11,14} be two sets. Let f: A→B be a function given by f(x) = 3x – 1. Represent this function,
    i)   by arrow diagram
    ii) in a table form
    iii) as a set of ordered pairs
    iv) in a graphical form

31. The sum of three consecutive terms that are in A.P. is 27, and their product is 288. Find the three terms.

32. Find the values of a and b if the following polynomials are perfect squares $4x^4 - 12x^3 + 37x^2 + bx + a$.

33. If A = $\begin{pmatrix} 1 & -1 \\ 2 & 3 \end{pmatrix}$ show that $A^2 - 4A + 5I_2 = 0$.

34. State and prove Pythagoras theorem.

35. Two poles of height 'a' metres and 'b' metres are 'P' metres apart. Prove that the height of the point of intersection of the lines joining the top of each pole to the food of the opposite pole is given by $\dfrac{ab}{a+b}$ metres.

36. Find the area of the quadrilateral formed by the points (8,6) (5,11) (-5,12) and (-4,3).

37. Find the equation of the perpendicular bisector of the line joining the points A(-4,2) and B(6,-4).

38. From a window (h meters high above the ground) of a house in a street, the angles of elevation and expression of the top and the foot of another house on the opposite side of the street are θ_1 and θ_2 respectively. Show the height of the opposite house is $h\left[1+\dfrac{\cot\theta_2}{\cot\theta_1}\right]$.

39. If the radii of the circular ends of a frustrum which is 45cm high are 28 cm and 7 cm, find the volume of the frustrum.

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40. A solid sphere of radius 6cm is melted into a hollow cylinder of uniform thickness. If the external radius of the base of the cylinder is 5cm and its height is 32cm, then find the thickness of the cylinder.

41. Two dice are rolled once. Find the probability of getting an even number on the first die or a total of face sum 8.

42. If S_n = $(x+y)$ + (x^2+xy+y^2) + $(x^3+x^2y+xy^2+y^3)$ +......n terms then

   prove that $(x-y)S_n = \left[\dfrac{x^2(x^n-1)}{x-1} - \dfrac{y^2(y^n-1)}{y-1} \right]$.

IV. Answer the following: 2×8=16

43. a) Construct a $\triangle$ PQR in which PQ = 8cm, $\angle$R = 60° and the median RG from R to PQ is 5.8cm. Find the length of the altitude from R to PQ.

(OR)

   b) Draw the two tangents from a point which is 5cm away from the centre of a circle of diameter 6cm. Also measure the lengths of the tangents.

44. a) Graph the following quadratic equations and state their nature of solutions. $x^2 - 9x + 20 = 0$.

(OR)

   b) A bus is travelling at a uniform speed of 50 km/hr. Draw the distance-time graph and hence find.
   i)   the constant of variation
   ii) how far will it travel in 90 minutes?
   iii) the time required to cover a distance of 300km from the graph.